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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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EXAMINER	
ZERVIGON,R	
ART UNIT	**PAPER NUMBER**
1763	12

DATE MAILED: 06/19/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Ex Copy

Office Action Summary

Application No.	Applicant(s)
09/123,352	Yunlong et al
Examiner	**Group Art Unit**
Rudy Zervigon	1763

X Responsive to communication(s) filed on *Sep 29, 1999*

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *3* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133) Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

X Claim(s) *1-16* is/are pending in the applicat

Of the above, claim(s) _____ is/are withdrawn from consideration

☐ Claim(s) _____ is/are allowed.

X Claim(s) *1-16* is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

X Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

X All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

X received.

☐ received in Application No. (Series Code/Serial Number) _____

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s) _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1, 6, 14, and 16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

3. The term "...dimension(s) of said axis..." in claims 1, 14, and 16 is a relative term which renders the claim indefinite. The term "...dimension(s) of said axis..." is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

4. Claim 6 is generally narrative and indefinite, failing to conform with current U.S. practice. They appear to be a literal translation into English from a foreign document and are replete with grammatical and idiomatic errors. "wherein, when" should just be "when".

Claim Rejections - 35 USC § 103

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6 Claims 1-11,13,16 are rejected under 35 U.S.C. 103(a) as being obvious over Sato Noriyoshi et al (JP5-354023 IDS reference) in view of Obinata (U.S. Pat. 4,624,767). Sato Noriyoshi et al describes an apparatus for plasma assisted operations (abstract). Specifically, Sato Noriyoshi et al describes a plasma generation chamber with the following attributes:

i. A plasma generation apparatus vacuum vessel (Abstract, purpose) having a plasma generation region formed from gas induction means for inducting discharge gas established in the interior thereof (abstract)

ii Exhaust means for exhausting the atmosphere in the interior of the vacuum vessel (item 7, abstract)

iii. A cylindrical discharge electrode (item 9, Figure 5) fashioned to enclose the plasma volume

iv A first high frequency electric power application means for applying high-frequency electric power to the cylindrical discharge electrode (item 19, Figure 5) fashioned to enclose the plasma volume

v. Magnetic force line formation means (items 401,402 Figure 5; abstract) for forming magnetic force lines having portions roughly parallel to the center axis of the cylindrical discharge electrode fashioned to enclose the plasma volume such that the length of the parallel portions become longer (less curved) the closer the magnetic force lines are to the central axis of the cylindrical discharge electrode fashioned to enclose the plasma volume (Figure 5)

vi Electrically conducting two walls (items 2,9 Figure 5) positioned so as to "sandwich" the plasma generation region between them in the dimension of the center axis of the cylindrical

discharge electrode (item 9, figure 5) fashioned to enclose the plasma volume for defining the scope of the plasma generation region in the center axial dimension

vii The magnetic force lines fashioned to enclose the plasma volume such that the length of the parallel portions become longer (less curved) the closer the magnetic force lines are to the central axis of the cylindrical discharge electrode (item 9, Figure 5) fashioned to enclose the plasma volume passing through a center of the plasma generation region.

Sato Noriyoshi et al does not explicitly describe magnetic field lines so shaped as *not to intersect the electrically conducting two walls positioned so as to "sandwich" the plasma generation region between them in the dimension of the center axis of the cylindrical discharge electrode fashioned to enclose the plasma volume for defining the scope of the plasma generation region in the center axial dimension*. Additionally, Sato Noriyoshi et al does not explicitly describe power application and distribution between a triode configuration, including resonant matching

Obinata describes an apparatus for plasma assisted operations applying magnetic field confinement means (abstract). Obinata shows magnetic field lines so shaped *not to intersect the electrically conducting two walls (chamber 1) positioned so as to "sandwich" the plasma generation region between them in the dimension of the center axis of the cylindrical discharge electrode (column 2, lines 26-28) fashioned to enclose the plasma volume (12a) for defining the scope of the plasma generation region in the center axial dimension.*

A person of ordinary skill in the art at the time the invention was made would find it obvious to modify the magnetic field confinement array of Sato Noriyoshi et al, if in fact needed, whereby the field lines can be shaped *not to intersect the electrically conducting two walls positioned so as to "sandwich" the plasma generation region between them in the dimension of the center axis of the cylindrical discharge electrode fashioned to enclose the plasma volume for defining the scope of the plasma generation region in the center axial dimension* as taught by Obinata. Motivation for altering the magnetic field array of Sato Noriyoshi et al is drawn from the common practice in the art to confine and control the plasma volume thereby influencing substrate processing. See Obinata (column 1, line 63-column 2, line2) in support of this position.

7. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato Noriyoshi et al (JP5-354023 IDS reference) and Obinata as applied to claims 1-11, 13/16 above, and further in view of Kinoshita et al. Sato Noriyoshi et al does not describe control means for controlling the magnitude of high frequency electric power. Kinoshita et al teaches a similar device including *control means for controlling the magnitude of high frequency electric power* of a multitude of dependent and independent plasma electrodes. Figure 6 shows electric power Ph1 and Ph2 of *high frequency power sources* 16, 26 are supplied to *first and second wall electrodes* 21, 22 at an arbitrary phase difference and an *arbitrary power supply ratio* through blocking capacitor 7. Motivation for this design is so that a part of the light electrons in the plasma run into *first wall electrode (21)* and into *second wall electrode (22)*, which is stored in blocking capacitors 7 so that a negative self-bias voltage is generated. Ion sheaths

in which positive ion densities are higher are generated in the neighborhood of *first wall electrode (21)* and *second wall electrode (22)* with the generation of the negative self-bias voltage. In the ion sheath section, there are positive ions having high densities. The ion sheath section increases so that strong electric fields are applied in a direction perpendicular to the *first and second wall electrodes* 21, 22.

A person of ordinary skill in the art at the time the invention was made would find it obvious to establish *a predetermined ratio of* electric power Ph1 and Ph2 of *high frequency power sources* 16, 26 supplied to *first and second wall electrodes* 21, 22 at an arbitrary phase difference and an *arbitrary power supply ratio* through blocking capacitor 7 (column 6, lines 16-23). Motivation for combining the above references is centered on providing plasma density and geometry control which are conducive to isotropic etching. This is additionally supported by Kinoshita et al (column 6, lines 16-23).

8. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato Noriyoshi et al (JP5-354023 IDS reference) as applied to claims 1-11 above, and further in view of Smesny et al and Saito et al. Sato Noriyoshi et al does not specifically address position adjustment means for adjusting positions of plasma confining walls. Smesny et al describes an integrated circuit dry etch chamber (item 90, Figure 5, column 12, lines 11-28). Smesny et al describe a *position adjustment means for*

adjusting positions of a movable first *electrically conductive* wall **electrode** (item 92, Figure 5, column 12, line 15).

A person of ordinary skill in the art at the time the invention was made would find it obvious to implement the enhancements of position adjustment means for adjusting positions of plasma confining walls as taught by Smesny et al and Saito et al to the Sato Noriyoshi et al apparatus in order to control plasma density and geometry attributes. The positioning of the upper and lower wall electrodes further confines and alters the plasma surface contour which is consistent with plasma density control and manipulation in order to control plasma processing near the substrate surfaces.

9. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato Noriyoshi et al (JP5-354023 IDS reference) as applied to claims 1-11 above, and further in view of Inazawa et al. Sato Noriyoshi et al does not precisely describe a wall functioning as a gas diffusion plate. Inazawa et al describe a similar plasma processing apparatus that is designed to increase the etching selection ratio, including an *upper first electrically conductive wall electrode* 40 having a hollow interior, and a large number of *gas diffusion holes* 42 formed in its entire surface opposite to a wafer W. A dispensing plate (not shown) is disposed in the *upper first electrically conductive wall electrode* 40. An etching gas fed into the *upper first electrically conductive wall electrode* 40 through a gas feed pipe 44 is uniformly sprayed into the processing chamber 16 through the gas diffusion holes 42.

A person of ordinary skill in the art at the time the invention was made would find it obvious to use a wall functioning as a gas diffusion plate as taught by Inazawa et al in the Sato Noriyoshi et al plasma reactor. Motivation for combining the above references is drawn from the added advantage to evenly distribute the process gas introduced into the process chamber over the entire length of the reactor volume.

Response to Arguments

10. Applicant's arguments with respect to claims 1-16 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 305-3599. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached then please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633.

GREGORY MILLS
PRIMARY EXAMINER
SUE 1763